2011

MicroCheck User Guide

Frequently Asked Questions

The following document provides answers to the most frequently asked questions concerning microbiology tests offered by National Milk Laboratories.

NML
national milk laboratories

Microbiology Unit
National Milk Laboratories
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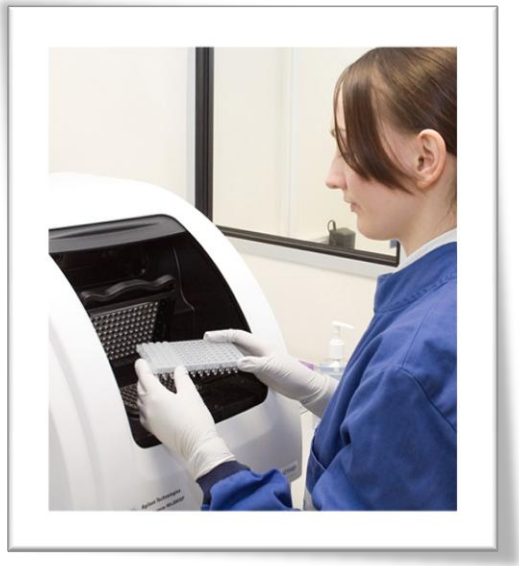
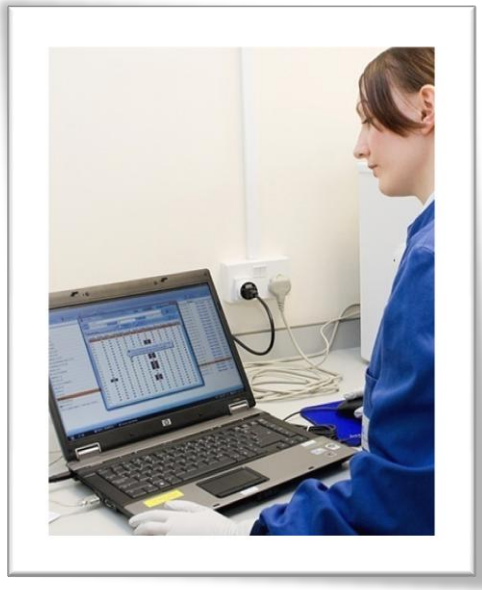




Customer Services Contact Details

Customer Services on 0844 7255567 customerservices@nmr.co.uk

Introduction

MicroCheck products

NML is committed to supplying a high quality and efficient testing service for its clients. Milk buyers, farmers and vets have been routinely using NMLs MicroCheck services since 2004. NMLs services include milk quality testing, antibiotic contaminant testing, traditional microbiology and modern molecular biology. NML have worked hard to ensure that customers can obtain results with ease in a timely manner.

This guide is intended to provide answers to common questions regarding NMLs Microbiology services. These services include:

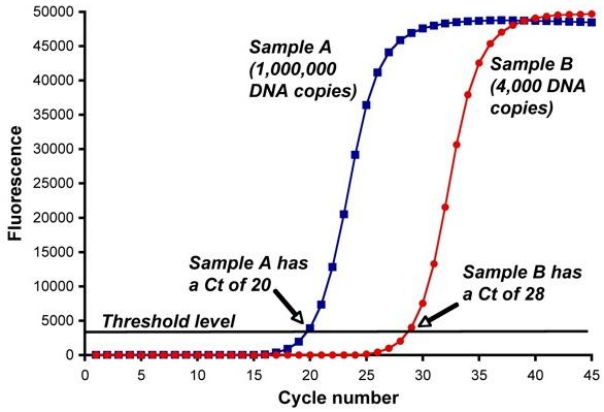
- qPCR
- Basic somatic cell counts (SCC)
- Culture testing

Each of these will be addressed in turn. It is important to note that SCCs are included within the Bacto Breakdown and Mastitis ID test suites.

Test methods

What is qPCR testing?

Quantitative Polymerase Chain Reaction (qPCR) is a molecular biological method for amplifying a specific DNA sequence within a sample. The reaction involves a DNA-binding fluorescent dye and requires a cyclical heating and cooling program. As specific DNA is formed, the fluorescence (proportional to the amount of DNA accumulating) is measured after each heat/cool cycle. If more DNA was present at the start, it takes a lower number of cycles for the amount of DNA to cross a threshold (Ct value). This method tells you whether a pathogen was present and by how much.



How does qPCR compare to bacterial culture?

Culture	qPCR
48 hours plus additional 24 hours for confirmation testing	3-4 hours
Uncontrolled microbial growth in raw milk	Can use bronopol preserved milk
Identify 7 targets (presumptive)	Identifies 12 targets including the staphylococcus penicillin resistance gene
Expertise and biochemical antibiotic tests for beta-lactamase resistance are unreliable	Ease of use and unambiguous interpretation of results

What is a somatic cell count?

Somatic cells are 'bacteria-fighting' cells or white blood cells that move to an infection site e.g. udder, and minimize the infection. It can be indicative of sub-clinical mastitis i.e. where cows exhibit no outward signs of mastitis.

SCC is important for identifying the problem in the first instance to indicate that a mastitis ID needs to be performed, and so then the specific bug (bacteria) can be identified. The test can be carried out on both bulk milk samples and individual cow samples. Kits are available and preservative can be used if no culture testing is required.

Why do I have a negative result for all the bacteria but a high somatic cell count?

Test Suite	Question
Bacto Breakdown Plant Hygiene	Has the sample been frozen? The bacteria have been killed and are no longer viable to culture. Freezing can cause ice crystals to form, which can cause lesions to the cell membrane of bacterial cells.
Mastitis ID	Was the preservative provided with the kit used?

Further possible reasons for high somatic cell counts, but negative qPCR results:

1. There are many mastitis-causing pathogens in milk, we only test for 11, and it could therefore be something else that we don't identify. Further analysis is provided by other testing agencies.
2. Malfunctioning machinery such as excessive liner slippage or fluctuating vacuum levels can lead to teat damage and high levels of mastitis infection.

Why don't I have a SCC reading?

If it states "Sour Milk Unreadable" for a mastitis sample then either the milk was already clotted upon leaving the cow or the preservative pill was not mixed thoroughly enough in the sample to prevent souring. If there are lumps in the milk it cannot pass through the fine tubing to obtain a somatic cell count reading.

Always ensure, when sending Bacto Breakdowns that ice packs are included with samples for cooling and use the insulated box provided to prevent the milk from souring quickly in the post. However, if there is high bacterial content the milk may sour more rapidly regardless of the presence of an ice pack. Psychrotrophs can grow at refrigeration temperatures and therefore if present can still cause the milk to sour. There have been examples of milk that has reached NML within 24 hours of sampling that has still been sour. For mastitis ID testing, always use the preservative provided.

Why does it say "Insufficient Sample Size"?

Insufficient sample size means that there was not enough milk provided or that the storage sample was also used for a variety of other tests. Payment tests for the milk buyers will take priority over any other tests, including MicroCheck.

I have always used bacterial culture, do you still offer this?

Yes we do, to an extent. Within our Bacto Breakdown service we culture for total viable counts (all live bacteria within the sample), Psychotrophs (bacteria that can grow at refrigerated temperatures), Coliforms (indicative of faecal contamination) and Thermodurics (bacteria that can withstand pasteurization at 63.5 ^{0}C).

Test Types

What is the difference between a Bacto Breakdown and a Mastitis ID?

Bacto Breakdowns utilise traditional bacteriology in addition to qPCR. They are performed on bulk tank samples and provide information concerning Plant (farm) hygiene and also provide an overview of mastitis within the herd. Mastitis ID can either be performed on a bulk tank sample to give an overview of the infection level within the herd or be performed on individual cow samples. It is simply the identification of pathogens through qPCR. The following table details the tests included within each test suite:

Individual Test	Bacto Breakdown	Mastitis ID
Total Viable Count *(TVC)* is a measure of all bacteria that is "alive" in the milk sample	√	
Coliforms are indicative of faecal (environmental contamination)	√	
Thermodurics are bacteria that can withstand pasteurization at 63.5C	√	
Psychrotrophs are bacteria that are able to grow at refrigerated temperatures	√	
Mastitis ID for 11 key mastitis causing pathogens along with Staphylococcus spp penicillin resistance using qPCR	√	√

What is Mastitis Tracker and how do I order it?

NMR Mastitis Tracker offers Mastitis qPCR testing to producers, using NMR samples. It is designed to act as a surveillance tool to track pathogen prevalence on farm. Samples from clinical cows should be tested using Mastitis ID kits rather than waiting until milk recording to avoid delay in obtaining results. Mastitis Tracker is an option on the NMR blue submission forms.

What are the costs for testing (veterinary pricelists are available)?

Test Suite	Price
Ad-hoc Bacto Breakdown	£45 + VAT per sample
Quarterly Surveillance Bacto Breakdown (4 per year tested automatically using NML sample)	£150 + VAT per year
1-5 Mastitis IDs ordered in one go	£17.50 + VAT per sample
>5 Mastitis IDs ordered in one go	£15 + VAT per sample
1 – 5 Mastitis Tracker samples	£14.00 + VAT per sample
>5 Mastitis Tracker samples	£13.00 + VAT per sample

Do you offer antibiotic sensitivity on the bacterial targets identified?

We do not offer antibiotic sensitivity testing; however we do identify the *Staphylococcus* penicillin-resistant gene, β-lactamase.

Sample Condition

How can samples be sent in?

Test Suite	Condition
Bacto Breakdown	Fresh samples only, either sent with ice packs or transported in a refrigerated van.
Mastitis ID	Fresh, frozen or bronopol preserved. Ensure preservative is mixed thoroughly and if the sample already has clots a SCC result will not be obtained.

Results

In what form can I receive my results?

- Post
- Fax
- Email
- Herd Companion website - Micro Monitor (Passwords are available from NMR)

Why did I not receive my qPCR results the same day the sample was received?

It is stated that we aim to return results the same day, but this is not a guaranteed service for the following reasons:

- DNA is extracted from the samples the same day, but only so many samples can fit into the machine, therefore samples received first are tested first.
- The sample may have an Internal Amplification Control (IAC) failure. IAC failures are caused by large quantities of bacterial DNA competing and inhibiting the reaction. The test is repeated with diluted DNA and the result calculated to account for the dilution used.

I have ordered a Bacto Breakdown, but I have only received one report, why?

Bacto Breakdowns generate 2 reports:

- qPCR report sent as soon as the testing is completed, usually within 24 hours
- Plant hygiene culture report within 5 working days

How do I obtain my Herd Companion username and password?

As an NMR/NML customer, you will have an assigned username and password. If you give your details to customer services, they will be able to issue you with your access details.

Can my vet access my results on Herd Companion?

If farmers sign an access agreement form, their vet will be able to instantly access health and testing reports. We recommend that farmers ensure their vet is informed of their test results and Herd Companion is a quick and easy way of doing this.

How do I know when results have arrived?

If we have an email address for the farmer, an automated email will be sent to ensure the farmer (and the vet - see above) is informed that results are available via Herd Companion.

Interpretation

qPCR

What do I do about this particular pathogen?

Customers are advised to consult their vet regarding result interpretation. It is important to remember that it isn't always the most abundant organism that is the cause of the infection.

Refer to Mastitis ID guidance notes (attached in the appendix).

Can samples that have been used for Payment testing be tested for Mastitis ID?

Testing samples through the payment machinery requires that samples are heated, which kills bacteria. With previous testing methods this was an issue as viable pathogens were required. However, qPCR technology amplifies bacterial DNA and therefore viable bacteria are not required.

Can I still have a qPCR test if the cow is being treated with antibiotics?

Milk from cows being treated with antibiotics can be tested; however the test will not distinguish between living and dead bacteria. This is useful if you wish to determine, which pathogen is present to ensure the correct antibiotic is being used, but it can take at least two weeks before dead bacteria are flushed out.

Plant Hygiene

The number of bacteria for Thermodurics, Psychrotrophs and Coliforms doesn't add up to the Total Viable Count (TVC), why not?

The results depend on the spread of the bacteria within the milk as it is shared between the tests. There may also be additional organisms making up the TVC that are not covered by thermodurics, psychrotrophs and coliforms.

Why do I have a high Coliform/ Thermoduric/ Psychrotroph/ TVC? What do I do?

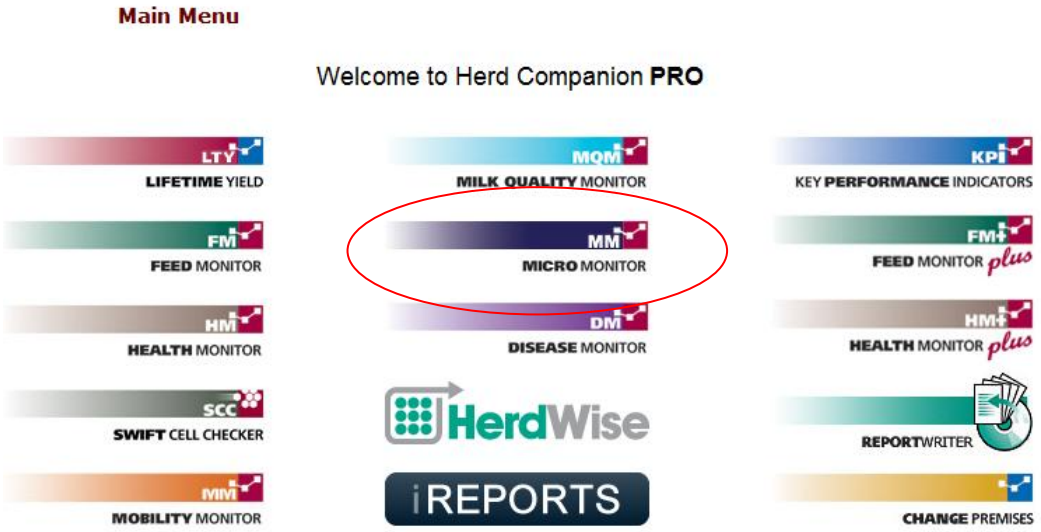
Refer to the Bacto Breakdown guidance notes (attached in the appendix).

National Milk Laboratories is not a farm consultancy firm and we can only advise customers to speak to milk hygiene consultants or veterinary practitioners.

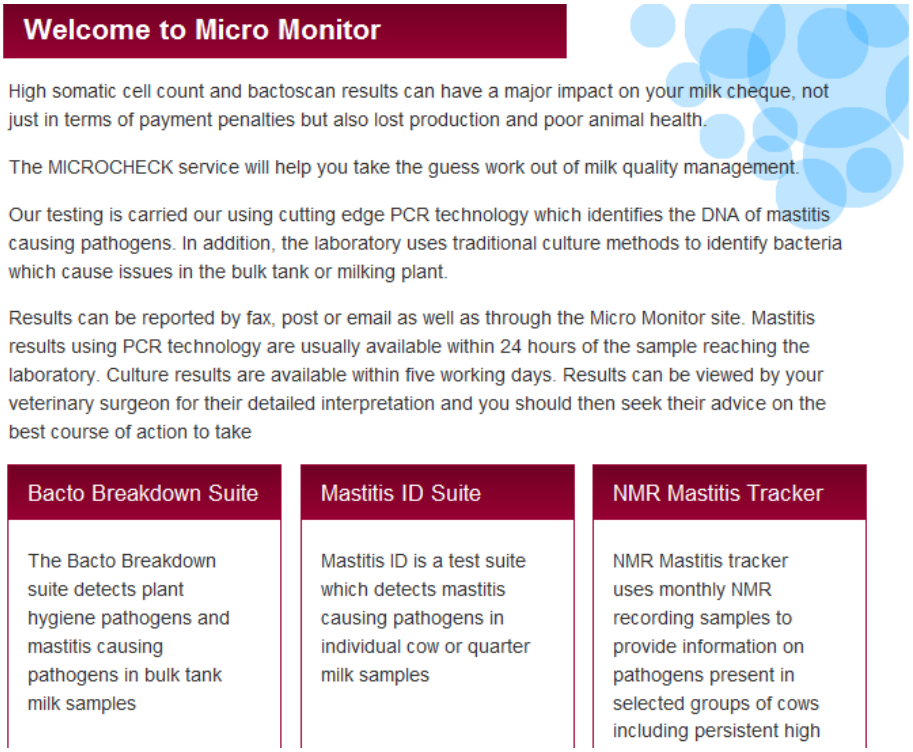
Appendix 1 – Online reporting

How do I access results online?

Both farmers and vets can access all test results via the Herd Companion website (http://www.nmr.co.uk/herd-companion/). When you access the main menu, click on the Micro Monitor (for Microbiology results).



Within Micro Monitor you can select the report you wish to view (see figure below).


Welcome to Micro Monitor
High somatic cell count and bactoscan results can have a major impact on your milk cheque, not just in terms of payment penalties but also lost production and poor animal health.
The MICROCHECK service will help you take the guess work out of milk quality management.
Our testing is carried our using cutting edge PCR technology which identifies the DNA of mastitis causing pathogens. In addition, the laboratory uses traditional culture methods to identify bacteria which cause issues in the bulk tank or milking plant.
Results can be reported by fax, post or email as well as through the Micro Monitor site. Mastitis results using PCR technology are usually available within 24 hours of the sample reaching the laboratory. Culture results are available within five working days. Results can be viewed by your veterinary surgeon for their detailed interpretation and you should then seek their advice on the best course of action to take
Bacto Breakdown Suite
The Bacto Breakdown suite detects plant hygiene pathogens and mastitis causing pathogens in bulk tank milk samples
Mastitis ID Suite
Mastitis ID is a test suite which detects mastitis causing pathogens in individual cow or quarter milk samples
NMR Mastitis Tracker
NMR Mastitis tracker uses monthly NMR recording samples to provide information on pathogens present in selected groups of cows including persistent high

If you select 'Mastitis ID suite', you are given a list of test reports (displayed below).

Mastitis ID Reports

Below is a list of Mastitis ID tests which have been conducted, click on the report column to view a chosen report

Batch Number	Sample Number	Sample Date	Report
80012536B	1766	02/09/2010	Mastitis ID
80012535B	3170	02/09/2010	Mastitis ID
80012535B	4	02/09/2010	Mastitis ID
80012536B	7563	02/09/2010	Mastitis ID
80012535B	7587	02/09/2010	Mastitis ID
80012536B	7616	02/09/2010	Mastitis ID
80012535B	7691	02/09/2010	Mastitis ID
80012536B	88	02/09/2010	Mastitis ID
80012535B	8871	02/09/2010	Mastitis ID
80012536B	9044	02/09/2010	Mastitis ID

Individual Cow Testing

To use the Mastitis ID service you need to order a sample testing kit. Once samples have been taken these can be returned to the lab in the pre-paid packaging supplied. To order a Mastitis ID kit please call 'NMR Customer Services' on 0844 7255567.

If you click on any of the reports, it will display the test results for that individual animal. An example report is displayed below.

NML Mastitis ID Report

Herd Number		**Sample Type**	Individual
Producer ID		**Sample Date**	02/09/2010
Batch Number		**Test Date**	06/09/2010
Sample ID		**Test Location**	NML – Wolves
Somatic Cell Count (SCC)		18,000	

Pathogen type	Pathogen	Test Result	Prevalence Level			Proportion
			+	++	+++	
Contagious	*Staphylococcus aureus*	NEG				
	Staphylococcus species (CNS)	POS				
	Streptococcus agalactiae	NEG				
	Streptococcus dysgalactiae	NEG				
	Corynebacterium bovis	NEG				
Environmental	*Streptococcus uberis*	NEG				
	Escherichia coli	NEG				
	Enterococcus species	NEG				
	Klebsiella species	NEG				
	Serratia marcescens	NEG				
	A. pyogenes and P. indolicus	NEG				
Penicillin resistance	*Staphylococcal β – lactamase gene*	NEG				

Appendix 2 – Individual Cow Mastitis ID guidance notes

qPCR individual cow test result interpretation

This test is designed to detect the presence of 11 key mastitis pathogens (responsible for >95% of cases) along with penicillin resistance in *Staphylococcus* species.

Results are reported according to the level of bacteria detected in preserved milk. Bacterial growth in transit does not occur but multiple pathogens can be detected.

Result Interpretation – Mastitis Pathogens

Result	*Low*	*Medium*	*High*	*Interpretation*
NEG				*Negative/not detected*
POS				*Positive in low numbers*
POS				*Positive in moderate numbers*
POS				*Positive in high numbers*

Where >90% or >99% of the bacterial load is attributed to one pathogen, this will appear in the report.

Pathogens can be split roughly into two groups:

1) Contagious mastitis pathogens: *Staphylococcus aureus,* other *Staphylococcal* species, *Corynebacterium bovis*, *Streptococcus agalactiae* & *Streptococcus dysgalactiae.* **Abbreviated hereafter as C.**

These organisms gain entrance into the mammary gland through the teat canal. Contagious organisms are well adapted to survival and growth in the mammary gland and frequently cause infections lasting weeks, months or years. The infected gland is the main source of these organisms in a dairy herd and transmission of contagious pathogens to uninfected quarters and cows occurs mainly during milking time.

2) Environmental mastitis pathogens: *Streptococcus uberis*, *E.coli, Enterococcus* species, *Serratia marcescens, Arcanobacterium pyogenes, and Klebsiella spp.* **Abbreviated hereafter as E.**

The primary source of environmental pathogens is the surroundings in which a cow lives. Housed cows are at greater risk from environmental mastitis than cows on pasture. Sources of environmental pathogens include manure, bedding, feedstuffs, dust, dirt, mud and water.

Low levels of some bacteria (e.g. CNS) can be treated with less urgency. However, different pathogens can have different infective doses. It is therefore important to discuss result interpretation with your vet. Presence of *Streptococcus agalactiae* and *E.Coli* at any level should be looked at as a matter of priority.

It is important to discuss treatment options with your vet

Guidance Notes

Staphylococcus aureus **-** **C** - Bacteria are shed from infected quarters in low numbers. Damage to the udder tissue reduces milk yield significantly. It is **often resistant to some of the common antibiotics, including penicillin**, and so it is important to use the correct antibiotics for treatment. Culling may be an option for persistent *S. aureus* cows.

Staphylococcus species (Coagulase Negative Staphylococci (CNS)) **-** **C** – Subclinical mastitis caused by intramammary infections (IMI) with coagulase-negative staphylococci (CNS) is common in dairy cows and may cause herd problems. Control of CNS mastitis is complicated by the fact that CNS contains a large number of different species and so veterinary advice should be sought. CNS is of **low pathogenicity**. Infections are usually subclinical and result in quarter somatic cell counts (SCC) only about two- to three-fold above that of uninfected glands. Despite their low pathogenicity, CNS infections can occasionally contribute to clinical cases of mastitis in dairy herds, but are rarely a major cause.

A positive result may show recovery of an organism but this does not mean inflammation of the mammary gland has occurred. Because CNS is commonly found on teat skin and in the streak canal, they are a common cause of contamination of milk samples. Repeated isolation from a particular quarter sampled multiple times builds the case for a persistent and important infection. Isolation in association with elevated SCC also supports the diagnosis of mastitis versus non-significant infection. **The most likely mastitis-causing bacteria should be ruled out before CNS is considered significant in suspected mastitis cases**.

Streptococcus agalactiae **-** **C** - Very high numbers of bacteria are shed and the cell counts can be as high as 10 million without any clinical signs. Herd cell counts also increase considerably with this form of mastitis. **Careful attention to teat dipping and dry cow therapy is essential** in controlling this organism.

Streptococcus dysgalactiae - **C** -is usually **associated with teat injury, either chaps or physical damage** that may be caused by **poor milking machine function**. Essential to **assess teat condition** and consider having the **parlour tested**. Infections tend to be subclinical.

Corynebacterium bovis - **C** - Sources of *C. bovis* are **infected udders and teat canal**. Spread of *C. bovis* is from **cow to cow at milking**. Proper **post milking teat disinfection** of cows with an efficacious germicidal teat dip will control the spread from cow to cow. Most cases are not clinical. **Dry cow therapy is very effective** to eliminate *C. bovis* intramammary infection.

Streptococcus uberis - **E** - A **common cause of new infection in the dry period**, and outbreaks can occur at pasture. It can produce mild to severe mastitis that can be difficult to treat. It can be shed in very high numbers by infected quarters. Sub-clinical infections may occur resulting in high cell count cows.

Escherichia coli (E.coli) **-** **E** - Effective control includes general cow and bedding hygiene and to prevent dry teat end exposure. Also **pre-dipping and drying teats** prior to milking may reduce infection during lactation.

Enterococcus faecalis and/or faecium **- E** – These bacteria are **found in the gut** and are an **indicator of faecal contamination**. Recommended control procedures include **effective milking time hygiene** and pre- and post-milking teat disinfection.

Klebsiella spp. - **E** – This is a member of the **coliform** family, are **found in the faeces**, in **bedding** and on **wet dirty udders**. Can cause transient, peracute or acute mastitis. They often increase in numbers in warm, wet weather. Coliform infections are associated with **environmental mastitis**.

Serratia marcescens **- E** - Infection can be sub-clinical or clinical. Treatment with antibiotics results in poor cure rates and is not recommended.

Corynebacterium bovis - **C** - Sources of *C. bovis* are **infected udders and teat canal**. Spread of *C. bovis* is from **cow to cow at milking**. Proper **post milking teat disinfection** of cows with an efficacious germicidal teat dip will control the spread from cow to cow. Most cases are not clinical. **Dry cow therapy is very effective** to eliminate *C. bovis* intramammary infection.

Arcanobacterium pyogenes **- E** -Sources include wound infections, teat injuries, udder infections, abscesses, and genital tracts. Spread may be due to contact of teats with a **contaminated environment**. *A. pyogenes* **may be transmitted by flies**. Control measures include fly control programs, maintaining cows in clean and dry calving areas, drying up ("killing") affected quarters to reduce the risk of spreading the infection to other cows, and removing the affected cow from the herd. *A. pyogenes* often cause an acute mastitis. Infections occur most frequently in **dry cows or heifers** before calving.

Penicillin Resistance: *Staphylococcal beta-lactamase gene*

If a positive Staph result is detected (this applies to both *Staph aureus* and *Staph* spp. results) the susceptibility of the pathogen to penicillin is also measured.

This is reported as follows:

Result	*Low*	*Medium*	*High*	*Interpretation*
NEG				*Susceptible to penicillin; suitable for use in treatment*
POS				*Resistant to penicillin; do not use in treatment*
POS				*Resistant to penicillin; do not use in treatment*
POS				*Resistant to penicillin; do not use in treatment*

Presence of the Staphylococcal beta-lactamase gene in the sample indicates there is likely to be some penicillin resistance in the herd. You should discuss mastitis treatment options with your vet.

Next steps

- ***Always discuss treatment of individual cows with your vet.***
- ***If gram positive bacteria or fungi are suspected (in rare cases), consider the use of culture testing (available through your vet).***
- ***In the case of environmental pathogens, consider the use of pre-dipping and drying of teats at milking.***
- ***Check udders for injury and discuss treatment with your vet.***
- ***Ensure milking machine function is optimal.***
- ***Results available through Micro Monitor on the Herd Companion website (via - www.nmr.co.uk). Please contact customer services for your free***

Appendix 3 – Bulk Milk Mastitis ID guidance notes

qPCR bulk milk test result interpretation

This test is designed to detect the presence of 11 key mastitis pathogens (responsible for >95% of cases) along with penicillin resistance in *Staphylococcus* species.

Results are reported according to the level of bacteria detected in preserved milk. Bacterial growth in transit does not occur but multiple pathogens can be detected.

Result Interpretation – Mastitis Pathogens

Result	*Low*	*Medium*	*High*	*Interpretation*
NEG				*Negative/not detected*
POS				*Positive in low numbers*
POS				*Positive in moderate numbers*
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Where >90% or >99% of the bacterial load is attributed to one pathogen, this will appear in the report.

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2) Environmental mastitis pathogens: *Streptococcus uberis*, *E.coli, Enterococcus* species, *Serratia marcescens, Arcanobacterium pyogenes, and Klebsiella spp.* **Abbreviated hereafter as E.**

The primary source of environmental pathogens is the surroundings in which a cow lives. Housed cows are at greater risk from environmental mastitis than cows on pasture. Sources of environmental pathogens include manure, bedding, feedstuffs, dust, dirt, mud and water.

Low levels of some bacteria (e.g. CNS) can be treated with less urgency. However, different pathogens can have different infective doses. It is therefore important to discuss result interpretation with your vet. Presence of *Streptococcus agalactiae* and *E.Coli* at any level should be looked at as a matter of priority.

It is important to discuss treatment options with your vet

Guidance Notes

Staphylococcus aureus **-** **C** - Bacteria are shed from infected quarters in low numbers. Damage to the udder tissue reduces milk yield significantly. It is **often resistant to some of the common antibiotics, including penicillin**, and so it is important to use the correct antibiotics for treatment. Culling may be an option for persistent *S. aureus* cows.

Staphylococcus species (Coagulase Negative Staphylococci (CNS)) **-** **C** – Subclinical mastitis caused by intramammary infections (IMI) with coagulase-negative staphylococci (CNS) is common in dairy cows and may cause herd problems. Control of CNS mastitis is complicated by the fact that CNS contains a large number of different species and so veterinary advice should be sought. CNS is of **low pathogenicity**. Infections are usually subclinical and result in quarter somatic cell counts (SCC) only about two- to three-fold above that of uninfected glands. Despite their low pathogenicity, CNS infections can occasionally contribute to clinical cases of mastitis in dairy herds, but are rarely a major cause.

A positive result may show recovery of an organism but this does not mean inflammation of the mammary gland has occurred. Because CNS is commonly found on teat skin and in the streak canal, they are a common cause of contamination of milk samples. Repeated isolation from a particular quarter sampled multiple times builds the case for a persistent and important infection. Isolation in association with elevated SCC also supports the diagnosis of mastitis versus non-significant infection. **The most likely mastitis-causing bacteria should be ruled out before CNS is considered significant in suspected mastitis cases**.

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Escherichia coli (E.coli) **-** **E** - Effective control includes general cow and bedding hygiene and to prevent dry teat end exposure. Also **pre-dipping and drying teats** prior to milking may reduce infection during lactation.

Enterococcus faecalis and/or faecium **-** **E** – These bacteria are **found in the gut** and are an **indicator of faecal contamination**. Recommended control procedures include **effective milking time hygiene** and pre- and post-milking teat disinfection.

Klebsiella spp. - **E** – This is a member of the **coliform** family, are **found in the faeces**, in **bedding** and on **wet dirty udders**. Can cause transient, peracute or acute mastitis. They often increase in numbers in warm, wet weather. Coliform infections are associated with **environmental mastitis**.

Serratia marcescens **-** **E** - Infection can be sub-clinical or clinical. Treatment with antibiotics results in poor cure rates and is not recommended.

Arcanobacterium pyogenes **-** **E** -Sources include wound infections, teat injuries, udder infections, abscesses, and genital tracts. Spread may be due to contact of teats with a **contaminated environment**. *A. pyogenes* **may be transmitted by flies**. Control measures include fly control programs, maintaining cows in clean and dry calving areas, drying up ("killing") affected quarters to reduce the risk of spreading the infection to other cows, and removing the affected cow from the herd. *A. pyogenes* often cause an acute mastitis. Infections occur most frequently in **dry cows or heifers** before calving.

Penicillin Resistance

Staphylococcal beta-lactamase gene

If a positive Staph result is detected (this applies to both *Staph aureus* and *Staph* spp. results) the susceptibility of the pathogen to penicillin is also measured.

This is reported as follows:

Result	*Low*	*Medium*	*High*	*Interpretation*
NEG				*Susceptible to penicillin; suitable for use in treatment*
POS				*Resistant to penicillin; do not use in treatment*
POS				*Resistant to penicillin; do not use in treatment*
POS				*Resistant to penicillin; do not use in treatment*

Presence of the Staphylococcal beta-lactamase gene in the sample indicates there is likely to be some penicillin resistance in the herd. You should discuss mastitis treatment options with your vet.

As with all results we recommend you analyse these in conjunction with your veterinarian who will be able to give you advice on management and treatment of mastitis.

Next steps

- ***Identify 'problem' cows using NMR records and veterinary guidance.***
- ***Discuss the need for further sampling with your vet.***
- ***Send samples (kits available from NML) for qPCR testing. Testing can be carried out on existing NMR samples (blue sample form required).***
- ***Results available through Micro Monitor on the Herd Companion website (via - www.nmr.co.uk). Please contact customer services for your free username and password.***

Appendix 4 – Bacto Breakdown guidance notes

BACTO BREAKDOWN GUIDANCE NOTES

PLANT HYGIENE REPORT

Test	Indicated problem	Target levels (cfu/ml unless otherwise stated)	Recommended actions
Total Viable Count 30°C A measure of all bacteria in the milk	Overall hygiene of production	**Green** <5,000 **Amber** 5,000-10,000 **Red** >10,000	Investigate bacteria from the udder/environment. check plant and/or bulk tank
Bactoscan (cells/ml)	Overall hygiene of production	**Green** <20,000 **Amber** 20,000 - 50,000 **Red** >50,000	Investigate bacteria from the udder/environment. check plant and/or bulk tank
Somatic Cell Count (cells/ml)	Sub-clinical mastitis	**Green** <150,000 **Amber** 150,000 – 250,000 **Red** >250,000	Review of mastitis management to prevent spread of infection
Coliforms 30°C Environmental contamination	Poor teat preparation	**Green** <20 **Amber** 20-40 **Red** >40	Check plant cleaning. Review pre-milking teat preparation (Pre-dipping recommended)
Thermodurics Bacteria that withstand high temperatures and grow in dirty milking systems	Inadequate plant cleaning	**Green** <150 **Amber** 150 - 500 **Red** >500	Poor plant cleaning. Ensure the boiler is heating correctly, check wash concentrations, volumes of solution etc.
Psychrotrophs 22°C Bacteria able to grow at refrigeration temperatures (can be found in water and bedding)	Inadequately cleaned bulk tank, poor milk cooling and/or dirty bedding	**Green** <500 **Amber** 500-5,000 **Red** >5,000	Check milk cooling and bulk tank cleaning. Review pre-milking teat preparation

FURTHER ADVICE ON INTERPRETING THESE RESULTS PLEASE CONSULT YOUR VET OR MILK QUALITY CONSULTANT

For more information on any of our services please call customer services on 0844 7255567

national milk laboratories

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